Listing of Claims:

1.(currently amended) A method for the microstructuring of an optical waveguide to produce an optical waveguide according to claim 20, comprising the steps of:

providing an optical waveguide comprising a first cross-sectional region having a first refractive index, a second cross-sectional area having a second refractive index, a protective buffer, and a boundary region in the transition from the first to the second cross-sectional area,

exposing the optical waveguide through its protective buffer to laser radiation in the form of at least an ultra-short single pulse or a sequence of ultra-short pulses with a defined energy input;

at least one of microdamaging and removing the material from the defined portion of the boundary region with said laser radiation: and

modifying at least one optical property of the optical waveguide at one said defined portion at least of the boundary region as a result of the step of exposing the optical waveguide to laser radiation, without removing said waveguide's protective buffer.

2. (previously amended) The method according to claim 1, wherein the modifying step includes changing the refractive index of the material of the first or of the second cross-sectional region or both.

3. (previously amended) The method according to claim 1, wherein the modifying step includes creating a scattering center by said microdamage or by said removal of material.

4. (previously amended) The method according to claim 1, wherein the modification step includes transforming the phase of the material of the first or of the second cross-sectional region.

5. (previously amended) The method according to claim 1, further comprising the step of selecting the laser radiation in such a manner that at the defined portion of the boundary region a charge carrier plasma with a charge carrier density dependent on the desired modification is produced.

6. (original) The method according to claim 5, in which the laser radiation comprises a power density of roughly 10^{10} W/cm^2 or of more than 10^{10} W/cm^2.

7. (original) The method according to claim 6, in which the laser radiation comprises single pulses having a duration of roughly 10^{70} seconds or of between 0.1 ps and 50 ps and an energy of roughly 10 nanojoules (nj) or less than 10 nanojoules (nj).

8. (previously amended) The method according to claim 6, further comprising the

step of selecting the wavelength of the laser radiation is chosen so that the optical waveguide is transparent in the light path up to the defined portion of the boundary region for light of the chosen selected wavelength up to a power density of roughly 10^{16} W/cm^2.

9. (previously amended) The method according to claim 1, further comprising the step of focusing a laser beam is focused onto the defined portion of the boundary region by means of a microscope lens.

10. (previously amended) The method according to claim 1, further comprising the step of irradiating a laser beam is irradiated so that it enters the optical waveguide at an angle of 90° to an outer face of said optical waveguide at the point of impact.

11. (previously amended) The method according to claim 1, further comprising the step of guiding a laser beam through an immersion fluid before entering into the optical waveguide.

12. (previously amended) The method according to claim 1, further comprising the step of producing the modification in such a manner that at the respective portion of the boundary region light can be coupled out of the waveguide or that light can be coupled into the waveguide at the respective portion of the boundary region, or that light can be coupled in and also coupled out at the respective portion of the boundary region.

13. (previously amended) The method according to claim 1 , further comprising the step of producing the modification on a plurality of defined portions of the boundary region in such a manner that from the modified boundary region portions a radial radiation of defined, uniform light intensity takes place when light is coupled into the optical waveguide at one longitudinal end.

14. (previously amended) The method according to claim 1, further comprising the step of producing the modification is produced at a plurality of defined portions of the boundary region in a longitudinal direction of the optical waveguide, or in a direction perpendicular thereto, or in both mentioned directions of the optical waveguide, in such a manner that an optical grating, a spiral, a cross, a photonic bandgap structure, a combination of lines and dots, or a combination of any of the above-mentioned structures, is produced.

15. (previously amended) The method according to claim 1, further comprising the step of moving the optical waveguide relative to the laser beam or moving the laser beam relative to the optical waveguide.

16. (original) The method according to claim 1, in which the first cross-sectional portion is an optical waveguide core and the second cross-sectional portion is an optical waveguide

cladding.

17. (previously amended) The method according to claim 1, in which the optical waveguide comprises from the inside to the outside more than two cross-sectional portions having different refractive indices and a corresponding number of boundary regions of adjacent cross-sectional portions, and wherein the method further comprises forming said modifications at more than one boundary region.

18. (original) The method according to claim 1, in which the optical waveguide comprises a continuous cross-sectional profile of the refractive index, and in which the modification takes place in at least one pre-selected cross-sectional portion.

19. (canceled)

20. (currently amended) An optical waveguide comprising:

a first cross-sectional region with a first refractive index, a second cross-sectional region with a second refractive index, a protective buffer, and a boundary region in the transition from the first to the second cross-sectional region, wherein said first cross-sectional region is composed of undoped silica,

wherein at least one defined portion of the boundary region is provided with a modification of at least one optical property of the optical waveguide, said modification being a non-periodic distribution, formed by a defined portion of the boundary region defining at least one of (i) microdamage, and (ii) a surface defined by the removal of material from the defined portion, wherein each of the microdamage and the surface defined by the removal of material is formed by subjecting said defined portion, without removal of its protective buffer, to laser radiation in the form of at least an ultra-short single pulse or a sequence of ultra-short pulses with a defined energy input.

21. (previously amended) The optical waveguide according to claim 20, in which the modification is further defined by a change in the refractive index of the material of the first or second cross-sectional region or of both.

22. (previously amended) The optical waveguide according to claim 20, wherein the defined portion of the boundary region forms a scattering centre.

23. (previously amended) The optical waveguide according to claim 20, in which the modification is further defined by a transformation of the phase of the material of the first or of the second cross-sectional region or of both.

24. (previously amended) The optical waveguide according to claim 20, in which the modification is constructed in such a manner that at the respective portion of the boundary

region light is coupled out of the waveguide, or in such a manner that light at the respective portion of the boundary portion can be coupled into the waveguide, or in such a manner that light can be coupled in and also coupled out at the respective portion of the boundary region.

25. (previously amended) The optical waveguide according to claim 20, in which the modification is provided at a plurality of defined portions of the boundary region in such a manner that from the modified boundary region portions a radial radiation of defined, uniform light intensity takes place if light is coupled into the optical waveguide at a longitudinal end.

26. (previously amended) The optical waveguide according to claim 20, in which the modification is disposed at a plurality of defined portions of the boundary region in a longitudinal direction of the optical waveguide or in a direction perpendicular thereto or both of said directions of the optical waveguide in such a manner that an optical grating, a spiral, a cross, a photonic bandgap structure, a combination of lines and dots, or a combination of the above-mentioned structures, is produced.

27. (currently amended) A device for microstructuring an optical waveguide with laser radiation to produce an optical waveguide according to claim 20, the device comprising:

a laser constructed to emit at least one light pulse, and

a focusing device,

wherein the laser radiation has a power density of roughly 10^{10} W/cm^2 or more and the laser and focusing device are configured (i) to transmit said laser radiation in the form of at least an ultra-short single pulse or a sequence of ultra-short pulses with a defined energy input into the defined portion of the boundary region, without removal of said waveguide's protective buffer; (ii) to at least one of microdamage and remove the material from the defined portion of the boundary region with said laser radiation; and (iii) to, in turn, modify the at least one optical property of the optical waveguide at said defined portion of the boundary region.

28.(original) The device according to claim 27, in which the laser is constructed to emit light pulses with a maximum duration of roughly 10^{40} seconds or of between 0.1 and 50 ps.

29. (original) The device according to claim 28, in which the laser is constructed to emit light pulses having an energy of roughly 10 nanojoules (nj) or less than 10 nanojoules (nj).

30. (original) The device according to claim 27, in which the frequency of the laser radiation is chosen to correspond to the material of the optical waveguide on the light path penetrated by radiation in the optical waveguide, so that laser radiation with a power density of

roughly 10^{10} W/cm^2 or of more than 10^{10} W/cm^2 can only enter the defined depth portion.

31. (previously amended) The device according to claim 27, further comprising a mounting for an optical waveguide, which is constructed to hold the optical waveguide so that it is displaceable in its a longitudinal direction or can rotate about a longitudinal axis of the optical waveguide, or both.

32. (original) The device according to claim 27, in which the focusing device is a microscope lens.

33. (previously amended) The device according to claim 27, wherein the focusing device is mounted and configured for performing one or more of the following movements: a displacement in a direction of the spacing of the optical waveguide,. or in a longitudinal direction of the optical waveguide, or a rotation about a longitudinal axis of the optical waveguide.

34. (original) The device according to claim 27, in which the optical waveguide and the focusing device are disposed in such a manner that a laser beam enters the optical waveguide at an angle of 90° to an outer face of said optical waveguide at the point of impact.